Appendix C

SUPPLEMENTAL NOISE AND VIBRATION INFORMATION

SUPPLEMENTAL NOISE AND VIBRATION INFORMATION

Terminology and Representative Sound Levels

The following section provides a more inclusive summary of some of the terminology used in the noise sections of chapters 3 and 4. Included is a chart of representative sounds and noises.

The decibel scale is commonly used in noise measurements and evaluation. The decibel scale is logarithmic, meaning that a 100-fold increase in sound energy corresponds to an increase of 20 decibels (dB), not 100 dB. A logarithmic scale uses the logarithm of a physical quantity instead of the quantity itself and is useful for representing quantities like sound levels that can vary over a large range. For example, two measurements of 10 units and 1,000,000,000 units might correspond to values of 1 and 9, respectively, on a logarithmic scale. Logarithmic units also add differently than linear units. For example, if one object is 6 feet long and a second is twice as long, the second object is 12 feet long. For sounds, however, if one sound level is 50 dB and a second is twice as loud, the second sound level is approximately 53 dB, not 100 dB.

There are various scales used to measure sounds using decibels. The most common noise metric is the overall A-weighted sound level measurement (dBA). This metric has been adopted by regulatory bodies worldwide. The A-weighting network measures sound in a way that is similar to how a person perceives or hears sound, thus achieving good correlation in terms of how to evaluate acceptable and unacceptable sound levels. A dBA is typically measured as an average noise level on an equal energy basis for a stated period of time (equivalent sound level, or L_{eq}), and is commonly used to measure steady-state sound or noise that is usually dominant. The day-night level, or L_{dn}, is a 24-hour average A-weighted L_{eq} noise level, where 10 dBA is added to nighttime levels between 10 p.m. and 7 a.m. to account for greater human sensitivity to nighttime noise levels. For a continuous source that emits the same noise level over a 24-hour period, the L_{dn} will be 6.4 dBA greater than the L_{eq}.

The relative dBA of common sounds measured in the environment and industry for various qualitative sound levels is provided in table C-1.

Table C-1. Sound Levels of Representative Sounds and Noises

Source	Sound Level (dBA)	Human Response
Jet takeoff (nearby)	150	
Jet takeoff (50 feet)	140	
50-HP siren (100 feet)	130	
Loud rock concert (near stage)	120	Pain threshold
Construction noise (10 feet)	110	Intolerable
Jet takeoff (2,000 feet)	100	
Heavy truck (25 feet)	90	
Garbage disposal (2 feet)	80	Constant exposure endangers hearing
Busy traffic	70	
Normal conversation	60	
Light traffic (100 feet)	50	Quiet
Library	40	

Table C-1. Sound Levels of Representative Sounds and Noises (Continued)

Source	Sound Level (dBA)	Human Response
Soft whisper (15 feet)	30	Very quiet
Rustling leaves	20	↕
Normal breathing	10	Barely audible
Threshold of hearing	0	↓

Source: Beranek (1988).

While no completely satisfactory way exists to measure the subjective effects of noise or to measure the corresponding reactions of annoyance and dissatisfaction, effects of noise on humans are generally listed in three categories:

- Subjective effects of annoyance, nuisance, dissatisfaction;
- Interference with activities (e.g., speech, sleep, learning, etc.); and
- Physiological effects (e.g., startling and hearing loss).

While workers in industrial plants may experience noise effects in the last category, environmental noise usually produces effects only in the first two categories. The lack of a common standard by which to evaluate individual thresholds of annoyance and habituation to noise means that an important way of determining a person's subjective reaction to a new noise is to compare it to the existing or "ambient" environment to which that person has adapted. In general, the more the level or the tonal (frequency) variations of a noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be as judged by the exposed individual. Therefore, an important metric to determine a person's subjective reaction to a new noise source is to compare it to the existing (i.e., ambient) environment.

Additional Laws, Ordinances, Regulations, and Standards

The following section provides a more inclusive summary of Federal, State, and local laws, regulations, and standards for noise that could impact Project construction and/or operation activities. This section is meant to supplement the discussion included in the noise section of chapter 3.

Occupational Safety and Health Administration, Occupational Health and Safety Act

The Occupational Health and Safety Act of 1970 established hearing conservation noise exposure regulations for workers (codified in 29 CFR 17.1910). The purpose of the act is to ensure safe and healthful working conditions. Worksite noise levels are regulated by Section 1910.95 of the act, which deals with occupational noise exposure. This section limits the noise pressure level to 90 dBA continuous exposure for an 8-hour day. If workers are exposed to an 8-hour time-weighted average of 85 dBA or greater, then a worker hearing protection program that includes baseline and periodic hearing testing, availability of hearing protection devices, and training in hearing damage prevention are required.

Department of Transportation

Several operating administrations of the U.S. Department of Transportation (USDOT) have identified criteria for the assessment of noise from short- and long-term construction activities for both stationary and mobile projects, such as linear projects.

The Federal Highway Administration (FHWA) of the USDOT recommends abatement of construction noise that exceeds certain maximum levels. The FHWA's noise abatement criteria outlined in the "Procedures for Abatement of Highway Traffic Noise and Construction Noise" specify a 1-hour L_{eq} level at which construction activity noise abatement should occur of 57 dBA for "[l]ands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose." All other locations, including residential areas, have a lower-limit outdoor 1-hour L_{eq} level for construction activity abatement of at least 67 dBA (23 CFR 772). While the FHWA construction noise abatement criteria were not developed to specifically address construction noise impact for power transmission line projects, the FHWA guidelines provide reasonable criteria for noise assessment. If these criteria are exceeded, adverse community reaction may result.

The USDOT's Federal Railroad Administration (FRA) and FTA use a sliding scale when evaluating ambient-based noise impacts. The noise impact criteria presented within figure C-1 are based on comparison of the existing outdoor noise levels with the future outdoor noise levels from the proposed Project for three land use categories. The y-axis represents the projected Project noise exposure in cumulative dBA while the x-axis presents the existing noise level. Category 1 land uses include lands where quiet is an essential element in their intended purpose. This includes lands set aside for serenity and quiet, along with such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks (NHLs) with significant outdoor use. Category 2 land uses include residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels, where a nighttime sensitivity to noise is assumed to be of utmost importance. Category 3 land uses include institutional land uses, schools, places of worship, and libraries (FTA 2006).

Bureau of Land Management Guidelines

The BLM is the Federal agency charged with managing public lands and is responsible for the development of energy resources on BLM-administered land. The BLM and DOE prepared a Programmatic EIS in November 2008 titled "Designation of Energy Corridors on Federal Land in the 11 Western States" (BLM and DOE 2008). While noise impacts were not expected to occur as a result of Project corridor designation, BLM guidelines outlined in this programmatic EIS can serve as guidance on how BLM may evaluate impacts from similar projects.

State and Local Regulations

Table C-2 presents noise related laws, ordinances, regulations, and standards that have been adopted for regional, County, and local city level. Pima County, Pinal County, and the City of Sierra Vista in Cochise County, Arizona, have noise regulations that are described in more detail below.

Figure C-1. FRA and FTA allowable increase in cumulative noise level. Note: Residential uses are included in Category 2.

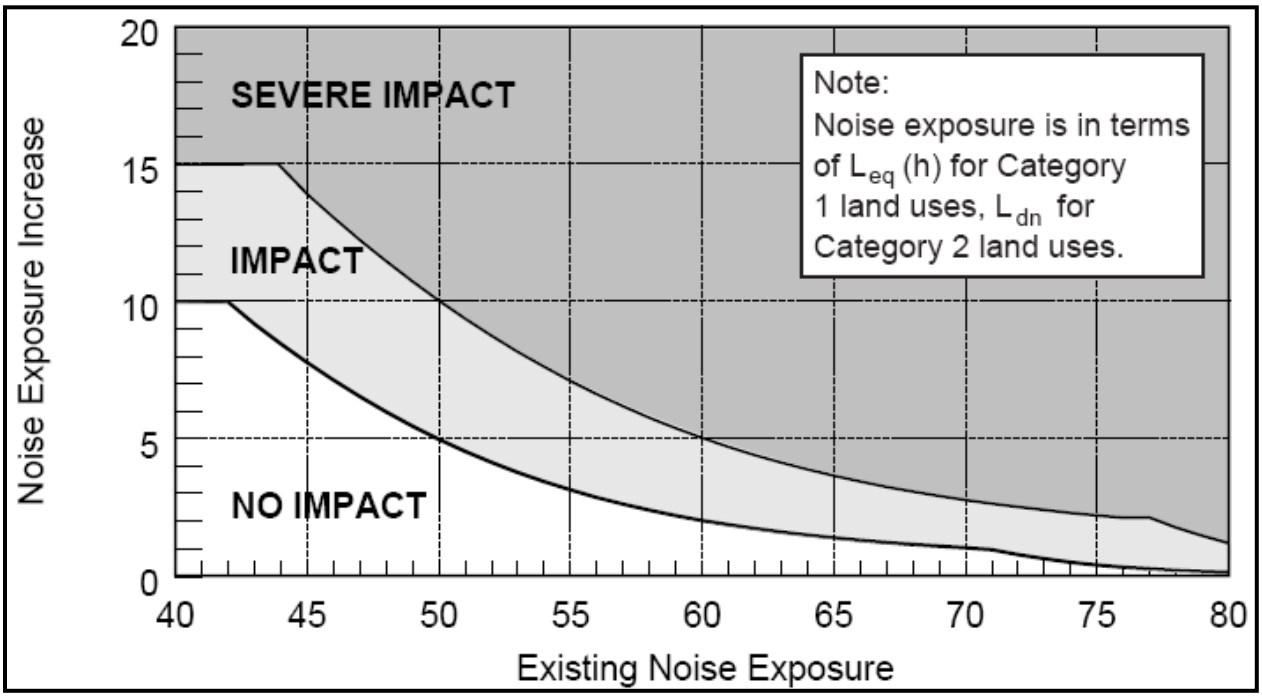


Table C-2. Applicable Regional and Local Plans, Laws, Ordinances, Regulations, and Standards Related to Noise

Jurisdictional	Laws, Ordinances, Regulations, and Standards (LORS)	Project Consistency with LORS
Counties		
Doña Ana County, New Mexico		
County of Doña Ana Comprehensive Plan" (1994)	No noise elements or policies addressing noise standards.	Yes
Doña Ana County Land Use Regulations and Zoning Ordinance (2008)	The plan addresses "excessive noise" in several zones, though a definition of excessive noise is not provided.	Expected
Luna County, New Mexico		
Comprehensive Plan for Luna County, New Mexico 2000–2020" (1999)	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise.	Expected
County of Luna Natural Resource Planning and Review Process (1994)	No noise elements or policies addressing noise standards.	Yes
Hidalgo County, New Mexico		
Hidalgo County Comprehensive Plan Update" (2011)	No noise elements or policies addressing noise standards.	Yes
Cochise County, Arizona		
Cochise County Comprehensive Plan" (2006)	No noise elements or policies addressing noise standards.	Yes
Cochise County Zoning Regulations (2008)	No noise elements or policies addressing noise standards.	Yes

Table C-2. Applicable Regional and Local Plans, Laws, Ordinances, Regulations, and Standards Related to Noise (Continued)

Jurisdictional	Laws, Ordinances, Regulations, and Standards (LORS)	Project Consistency with LORS
Counties, cont'd.		
Graham County, Arizona		
Graham County Land Use and Resource Policy Plan" (1996)	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise.	Expected
Graham County Comprehensive Plan" (2002)	No noise elements or policies addressing noise standards.	Yes
An Ordinance Regarding Construction, or Facilities, within Grant County Road Rights-of-Way (1978)	No noise elements or policies addressing noise standards.	Yes
Greenlee County, Arizona		
Greenlee County Comprehensive Plan" (2003)	No noise elements or policies addressing noise standards.	Yes
Greenlee County Planning and Zoning Regulations (2007)	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise.	Expected
Pima County, Arizona		
Pima County Comprehensive Plan" (1992)	Residents should be protected to a reasonable extent from continued long-term exposure to high levels of noise and from increasing levels of noise.	Expected
Pima County Code (1985)	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise. Construction hours are limited to times outlined in table C-3 because of noise potential.	Expected
Pinal County, Arizona		
Pinal County Development Services Code (2006a)	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise.	Expected
Pinal County Comprehensive Plan" (2010)	Establishes a noise-sensitive area with the intent to encourage land use compatibility with airport activities. The noise-sensitive area designation is an overlay designation with additional stipulations to the underlying designations to "reduce interior noise levels to 45 L_{dn}, day-night average sound level, or lower." An objective of the plan is to minimize noise near places people live. However, there are no explicit maximum noise levels for areas outside the noise-sensitive area overlay.	Expected
Excessive Noise Ordinance (2006b)	The ordinance prohibits any noise that exceeds certain levels. Noise levels are permitted to be higher in commercial and industrial areas than in residential areas. The policy states further that at and above these levels, noise is excessive and detrimental to the health and welfare of the citizens of the County, and should be eliminated. The requirements of this noise ordinance as they relate to the proposed Project and alternatives are discussed further below.	Expected

Table C-2. Applicable Regional and Local Plans, Laws, Ordinances, Regulations, and Standards Related to Noise (Continued)

Jurisdictional	Laws, Ordinances, Regulations, and Standards (LORS)	Project Consistency with LORS
Cities		
City of Deming, New Mexico		
City of Deming Comprehensive Plan Update" (2010)	No noise elements or policies addressing noise standards.	Yes
City of Deming Municipal Code (2001)	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise.	Expected
City of Willcox, Arizona		
City of Willcox General Plan Update" (2009)	No noise elements or policies addressing noise standards.	Yes
City of Benson, Arizona		
City of Benson General Development Plan" (2002)	The plan acknowledges that Benson sits within a transmission corridor. Included in the Environmental Planning element, Policy 3 indicates that the City should employ noise buffers of native vegetation between roadways and residential areas to reduce noise load impact of increased traffic, and Policy 4 recommends that the City develop a noise level benchmark of current conditions to compare with future noise levels. However, there are no explicit maximum noise levels stated in the plan.	Expected
City Code of the City of Benson, Arizona (2006)	The code limits conditional uses such that noise levels and lights from the facility will not interfere with adjacent land uses or in any way create a nuisance and that noise impacts from nonresidential development should be abated to acceptable residential levels at residential property lines.	Expected
City of Sierra Vista, Arizona		
Sierra Vista Development Code (2009)	The code contains an article to identify acceptable levels of noise and other emissions in various land use categories. The allowed sound levels between land use districts are discussed further below.	Expected
City of South Tucson, Arizona		
City of South Tucson Comprehensive Plan" (1999)	No noise elements or policies addressing noise standards.	Yes
City of Tucson, Arizona		
City of Tucson Land Use Code (1995)	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise.	Expected
City of Tucson General Plan" (2001)	Industrial development should utilize appropriate design elements to mitigate visual, noise, odor, and other potential impacts on adjacent uses while improving the streetscape and contributing positively to the overall function and aesthetic quality of the community.	Expected
Town of Marana, Arizona		
Marana General Plan" (2010)	No noise elements or policies addressing noise standards.	Yes

Table C-2. Applicable Regional and Local Plans, Laws, Ordinances, Regulations, and Standards Related to Noise (Continued)

Jurisdictional	Laws, Ordinances, Regulations, and Standards (LORS)	Project Consistency with LORS
Cities, cont'd.		
Official Code of the Town of Marana, Arizona (2012)	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise. It shall be unlawful to allow or cause site construction activities that result in disturbance to persons residing within 500 feet of the site between the hours of 7 p.m. and 6 a.m. on weekdays and between 7 p.m. and 7 a.m. on weekends.	Expected
City of Eloy, Arizona		
City of Eloy General Plan" (2011)	The city shall actively coordinate with electric companies regarding placement, design, and size of proposed and future transmission lines. The plan states that screening techniques (i.e., landscaping, distance, berming, and fencing) shall be used to shield and buffer adjacent residential uses from noise generated by industrial uses.	Expected
City of Eloy Zoning Code and Map	Limits uses such that the establishment, maintenance, or operation of the proposed use shall not be noxious or offensive by reason of noise.	Expected

Pima County contains noise regulations in Chapter 9.30.070, "Construction of Buildings and Other Projects," of the Pima County Code. These standards regulate noise emitted from construction activities on buildings, structures, or projects within the times listed in table C-3.

Table C-3. Pima County Noise Construction Time Restrictions

Concrete Work		Other Type Construction (Residential Zones)		Other Type Construction (Commercial and Industrial Zones)	Weekends and Holidays	
April 15 to October 15	October 16 to April 14	April 15 to October 15	October 16 o April 14	Year-round	Construction or repair work	Concrete pouring
5 a.m. to 7 p.m.	6 a.m. to 7 p.m.	6 a.m. to 7 p.m.	7 a.m. to 7 p.m.	5 a.m. to 7 p.m.	7 a.m. to 7 p.m.	6 a.m. to 7 p.m.

Source: Pima County (1985).

Note: Construction start/stop times are requirements unless authorized for other times by a permit.

While Pima County regulates construction during certain times, there are no maximum noise levels for any type of construction or activity. Section 9.30.070 states that "it shall be unlawful for any person to operate equipment or perform any outside construction or repair work on buildings, structures or projects, or to operate any pile driver, power shovel, pneumatic hammer, derrick, power hoist or any other construction type device except within the time periods specified below unless an appropriate permit has been obtained beforehand from the county."

Baseline Noise Levels

The following section presents more information on baseline noise conditions as discussed in the noise section of chapter 3. Included are tables detailing anticipated noise levels based on land use, heavy truck

traffic conditions, baseline noise levels at existing substations, and noise levels of representative construction equipment.

Anticipated Noise Levels by Land Use

Table C-4 shows estimated ranges of sound levels from different land uses during the day and at night (Bishop and Schomer 1991). These ranges can be used to give an estimation of what existing sound levels are along the corridor based on existing land uses.

Table C-4. Land Use and Anticipated Noise Levels

Location	Daytime Outdoor dBA, L_{eq}		Nighttime Outdoor dBA, L_{eq}	
	Minimum	Maximum	Minimum	Maximum
3rd-floor apartment, next to freeway	76	89	62	87
3rd-floor apartment, downtown Los Angeles	69	85	61	80
2nd-floor apartment, New York City	62	83	58	78
Urban shopping center	59	71	49	65
Popular beach on Pacific Ocean	52	69	49	63
Urban residential near major airport	48	92 (aircraft landing)	45	88 (aircraft landing)
Urban residential near ocean	48	70	44	52
Urban residential 6 miles to major airport	44	69	40	66 (distant aircraft)
Suburban residential near railroad tracks	43	68	39	66 (train idling)
Urban residential	44	66	42	64
Urban residential near small airport	45	74 (aircraft takeoff)	38	56 (no aircraft)
Old residential near city center	42	64	43	61
Suburban residential at city outskirts	40	67 (aircraft overhead	33	55 (no aircraft)
Small town residential cul-de-sac	38	57	35	52
Small town residential main street	36	65 (main street traffic)	34	56
Suburban residential in Hill Canyon	33	66 (canyon traffic)	43	61 (traffic and crickets)
Farm in valley	30	52	30	40
Grand Canyon (North Rim)	8	45 (sightseeing traffic)	20	40

Source: Bishop and Schomer (1991).

Baseline Roadway Noise

Potential noise levels that would occur from heavy truck traffic are listed in table C-5. These values will be representative of areas where traffic would represent an existing source of noise.

Table C-5. Noise Levels at Various Distances from Heavy Trucks

	Noise Level $L_{eq(1-h)}$ at Distances (dBA)					
Hourly Vehicle Traffic	**50 feet**	**250 feet**	**500 feet**	**1,000 feet**	**2,500 feet**	**5,000 feet**
1	51	44	41	38	34	31
10	61	54	51	48	44	41
50	68	61	58	55	51	48
100	71	64	61	58	54	51

Substation Operational Noise

To assess operational and maintenance impacts of the proposed Project and alternatives, the approximate existing noise levels at the proposed substation sites are presented in table C-6.

Table C-6. Current Noise at Proposed Substation Sites along New Build Section

Section	**Substation**	**Distance to Closest Noise-Sensitive Receptor (in feet)**	**Approximate Substation Noise Based on Existing Conditions at Noise-Sensitive Receptor**
New Build	Afton	35,942	< 40 dBA
	Apache	2,736	40 dBA
	Hidalgo	15,120	< 40 dBA
Upgrade	Pantano	13,247	< 40 dBA
	Adams Tap	11,977	< 40 dBA
	Nogales	5,711	< 40 dBA
	Vail	5,534	< 40 dBA
	Rattlesnake	10,687	< 40 dBA
	Tucson-DMP	934	41 dBA
	Marana	512	<40 dBA
	Saguaro/Tortolita	11,484	< 40 dBA
	De Moss Petrie	1,476	41 dBA

Analysis Assumptions

The following section provides a more inclusive summary of the noise calculation assumptions from the Project and alternatives. This section is meant to supplement the discussion included in the noise section of chapter 4.

Other published noise data can be found in one of the most recent and comprehensive compilations of construction equipment noise developed in the United States: the Federal Highway Administration's (FHWA's) "Roadway Construction Noise Model (RCNM) User's Guide" (Final Report, January 2006, FHWA-HEP-05-054, DOT-VNTSC-FHWA-05-01). The RCNM model includes noise levels for several categories of construction equipment, the nosiest of which include impact and vibratory pile drivers (95 dBA at a distance of 50 feet).

A review of the literature on construction equipment noise levels indicates that the loudest equipment generally emits noise in the range of 80 to 90 dBA at 50 feet. Noise at any specific receptor is dominated by the closest and loudest equipment. The types and numbers of construction equipment near any specific receptor location will vary over time. In order to make reasonably conservative estimates of construction noise, it was decided to model a scenario consisting of the following:

- One piece of equipment generating a reference noise level of 85 dBA (at 50 feet distance with a 40 percent usage factor) located on the easement or property line;
- Two pieces of equipment generating reference 85 dBA noise levels located 50 feet farther away on the easement or property line; and
- Two more pieces of equipment generating reference 85-dBA noise levels located 100 feet farther away on the easement or property line.

For example, the level at 50 feet from the ROW was based on one piece of equipment at 50 feet from the receptor, two pieces at 100 feet, and two pieces at 150 feet. The level at 100 feet from the ROW was based on one piece of equipment at 100 feet, two pieces at 150 feet, and two pieces at 200 feet. The level at 200 feet from the ROW was based on one piece of equipment at 200 feet, two pieces at 250 feet, and two pieces at 300 feet. As described in the RCNM User's Guide, the level from each piece of equipment is determined by the following formula for geometric spreading:

*Reference Noise Level – 20*log(Distance to Receptor/50) + 10*log(Usage Factor %/100)*

Thus for the scenario where all equipment has a reference level of 85 dBA and a usage factor of 40 percent, the contribution of each piece of equipment was determined by the following formula:

*85 dBA – 20*log(Distance to Receptor/50) + 10*log(40/100)*

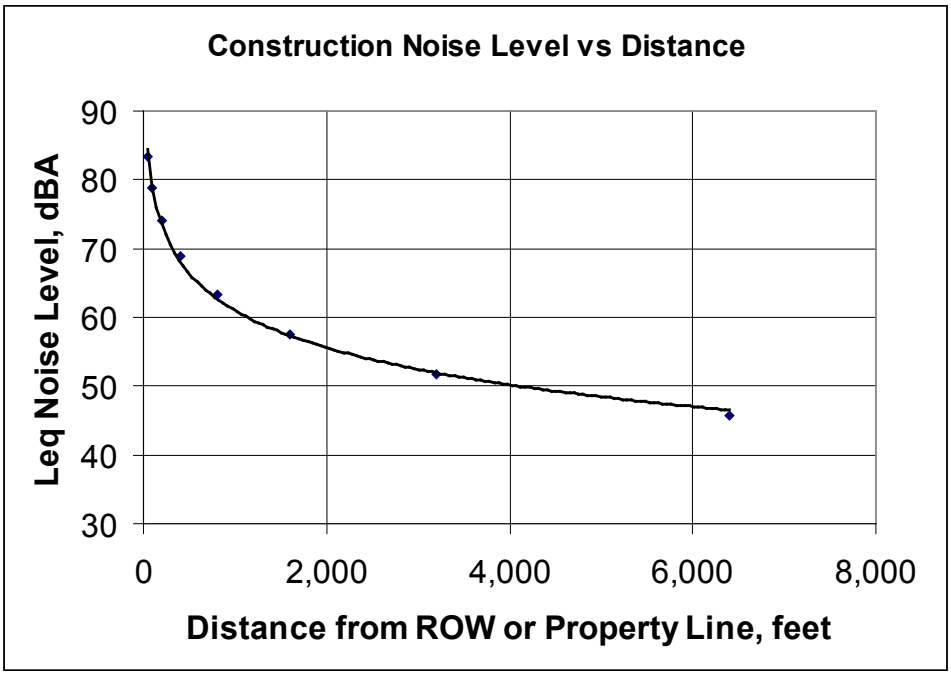
The model determines the total reference level by adding the decibel contribution of each piece of equipment. Construction equipment noise levels at various distances, based on this scenario and under the conditions discussed, are presented in table C-7.

Table C-7. Construction Equipment Noise Levels by Distance

Distance from ROW or Property Line (feet)	L_{eq} Noise Level (dBA)
50	83
100	79
200	74
400	69
800	63
1,600	58
3,200	52
6,400	46

The data in table C-7 are plotted in figure C-2. The expected construction noise levels from proposed transmission line construction activities at any particular location may be estimated using this figure.

Figure C-2. Construction equipment noise levels by distance.



Noise Sensitive Receptors

The following section lists out identified non-residential noise sensitive receptors within the noise area of analysis by route group. This section is meant to supplement the discussion included in the noise section of chapter 4.

Route Group 1 – Afton Substation to Hidalgo Substation

The New Build Section of the proposed Project and alternatives between the Afton Substation to Hidalgo Substation passes by five non-residential noise-sensitive receptors and scattered residential areas, primarily near the community of Deming. However, this route group is predominantly open space and has very few noise-sensitive receptors (table C-8).

Table C-8. Route Group 1: Noise Sensitive Receptors within Analysis Area

Type of Receptor	Name of Receptor	Distance from Edge of Representative ROW (feet)	Construction Noise Level at NSR (dBA)	Segment
Cemetery	Holy Cross Cemetery	4329	52	Proposed Route, P2
Cemetery	Victorio Cemetery	52	83	Alt. Southern Route, S7
Cemetery	Hachita Cemetery	633	69	Alt. Southern Route, S7
Cemetery	Shakespeare Cemetery	1742	58	Local Alternative D
Church	Hachita Baptist Church	633	69	Alt. Southern Route, S7

Route Group 2 – Hidalgo Substation to Apache Substation

There are six non-residential NSRs identified for this Route Group (five schools and one cemetery). These NSRs are presented in table C-9.

Table C-9. Route Group 2: Noise Sensitive Receptors within Analysis Area

Type of Receptor	Name of Receptor	Distance from Edge of Representative ROW (feet)	Construction Noise Level at NSR (dBA)	Segment
Cemetery	Desert Rest	2428	58	Local Alternative F
School	San Simon Elementary School	4488	52	Local Alternative E
School	San Simon High School	4488	52	Local Alternative E
School	Bowie Elementary School	5227	52	Local Alternative F
School	Bowie High School	5068	52	Local Alternative F
School	Cochise Elementary	897	63	Local Alternative G

Route Group 3 – Apache Substation to Pantano Substation

There are forty non-residential NSRs identified for this route group, which includes churches, schools, museums, libraries, and parks. These NSRs are presented in table C-10.

Table C-10. Route Group 3: Noise Sensitive Receptors within Analysis Area

Type of Receptor	Name of Receptor	Distance from Edge of Representative ROW (feet)	Construction Noise Level at NSR (dBA)	Segment
Church	Living Faith Fellowship	700	69	Proposed Route U2
Church	LDS Church	3900	52	Proposed Route U2
School	Full Gospel Assembly School	2000	58	Proposed Route U2
School	Visions Unlimited Academy	4700	52	Proposed Route U2
School	Benson Primary/Middle/ High School	5100	52	Proposed Route U2
Museum	Benson Museum	4500	52	Proposed Route U2
Church	Our Lady of Lourdes	4900	52	Proposed Route U2
Library	Benson Public Library	5100	52	Proposed Route U2
Church	Assembly of God	3100	58	Proposed Route U2
Church	River of Life Christian PCG	2200	58	Proposed Route U2
Church	Calvary Baptist Church	2400	58	Proposed Route U2
Church	Skyline Baptist Church	600	69	Proposed Route U2
Church	Peace in the Valley Lutheran	3800	52	Proposed Route U2
School	New West School	1700	58	Proposed Route U2
School	Andrada High School	3400	52	Proposed Route, U3a
School	Pantano High School	3600	52	Proposed Route, U3a
School	Santa Clara Elementary School	900	63	Proposed Route, U3a
School	Academy del Sol	1000	63	Proposed Route, U3a
School	Southgate Academy	800	63	Proposed Route, U3a
School	Elvira Elementary School	4100	52	Proposed Route, U3a

Table C-10. Route Group 3: Noise Sensitive Receptors within Analysis Area (Continued)

Type of Receptor	Name of Receptor	Distance from Edge of Representative ROW (feet)	Construction Noise Level at NSR (dBA)	Segment
Church	Apostolic Bethel Temple	3800	52	Proposed Route, U3a
Church	Jehovah Witnesses	3000	58	Proposed Route, U3a
Church	St. Monica Catholic Parish	4400	52	Proposed Route, U3a
Church	Manor Baptist Church	3300	52	Proposed Route, U3a
School	Math and Science Success Academy	3400	52	Proposed Route, U3a
Church	Church of Jesus Christ of Latter-day Saints	4000	52	Proposed Route, U3a
School	San Miguel High School	4400	52	Proposed Route, U3a
Church	The Cool Church	4600	52	Proposed Route, U3a
School	Tucson International Academy	3500	52	Proposed Route, U3a
School	Ombudsmen - Charter Valencia	4000	52	Proposed Route, U3a
Church	Desert Dove Christian Church	3300	52	Proposed Route, U3a
School	Mission Manor Elementary	1700	58	Proposed Route, U3a
Park	Mission Manor Park	1700	58	Proposed Route, U3a
Library	Desert Vista Library	600	69	Proposed Route, U3a
Park	Fiesta Park	4600	52	Proposed Route, U3a
School	Arizona Academy of Leadership	2500	58	Proposed Route, U3a
School	Liberty Elementary	4500	52	Proposed Route, U3a
School	Apollo Middle School	4800	52	Proposed Route, U3a
Church	New Horizon Temple	2200	58	Proposed Route, U3a
Church	Welcome Baptist Church	4700	52	Proposed Route, U3a

Route Group 4 – Pantano Substation to Saguaro Substation

There are 75 non-residential NSRs identified for this route group (which includes parks, schools, churches, hospitals, libraries, and cemeteries). These NSRs are presented in table C-11.

Table C-11. Route Group 4: Noise Sensitive Receptors within Analysis Area

Type of Receptor	Name of Receptor	Distance from Edge of Representative ROW (feet)	Construction Noise Level at NSR (dBA)	Segment
Park	Oaktree Park	1000	63	Proposed Route, U3c
School	Raul Grijalva Elementary School	3000	58	Proposed Route, U3c
Church	Jehovah Witnesses	4000	52	Proposed Route, U3c
School	White Elementary School	4800	52	Proposed Route, U3c
Church	Freedom's Gate Ministries	4500	52	Proposed Route, U3c
Church	Pleasant View Baptist Church	5000	52	Proposed Route, U3c
Church	Cactus Community Church	1300	63	Proposed Route, U3c
Church	Charity Tabernacle	1500	63	Proposed Route, U3d
School	McCorkle K-8 School	2300	58	Proposed Route, U3d

Table C-11. Route Group 4: Noise Sensitive Receptors within Analysis Area (Continued)

Type of Receptor	Name of Receptor	Distance from Edge of Representative ROW (feet)	Construction Noise Level at NSR (dBA)	Segment
Church	Our Lady of Fatima Parish	300	74	Proposed Route, U3d
Church	Mission Park Baptist Church	300	74	Proposed Route, U3d
School	Lynn Elementary School	4200	52	Proposed Route, U3d
Church	House of Prayer	4000	52	Proposed Route, U3d
School	Oyama Elementary School	700	69	Proposed Route, U3d
Church	West Side Church of God	2900	58	Proposed Route, U3d
Church	Emmanuel Grace Apostolic	3300	52	Proposed Route, U3d
Church	Christ Kingdom Fellowship Church	4200	52	Proposed Route, U3d
Park	San Juan Park	1400	63	Proposed Route, U3d
School	Cholla High School	1400	63	Proposed Route, U3d
School	Tolson Elementary School	1300	63	Proposed Route, U3e
Park	Sentinel Peak Park	4000	52	Proposed Route, U3f
School	Tucson International Academy - West	3500	52	Proposed Route, U3f
School	Menlo Park Elementary School	3600	52	Proposed Route, U3g
Park	Menlo Park	3500	52	Proposed Route, U3g
Hospital	St. Mary's Hospital	300	74	Proposed Route, U3g
School	Manzo Elementary School	3000	58	Proposed Route, U3g
Church	Victory Baptist Church	1000	63	Proposed Route, U3g
Church	Trinity Hope Church of God	2900	58	Proposed Route, U3g
Library	El Rio Branch Public Library	2600	58	Proposed Route, U3g
Park	Joaquin Murrieta Northwest Park	0	83	Proposed Route, U3h
School	Brichta Elementary	2600	58	Proposed Route, U3h
School	Tully Elementary School	400	69	Proposed Route, U3h
Church	Most Holy Trinity Catholic Church	5000	52	Proposed Route, U3h
Church	Trinity Missionary Baptist Church	3500	52	Proposed Route, U3h
Park	Riverview Park	2300	58	Proposed Route, U3h
Church	Northwest Spanish SDA Church	1000	63	Proposed Route, U3h
School	Ironwood Hills School	3700	52	Proposed Route, U3h
Church	Open Heavens Fellowship	1600	58	Proposed Route, U3h
Church	Faith Christian Fellowship	1600	58	Proposed Route, U3h
School	Richey Elementary School	3300	52	Proposed Route, U3i
School	Nash Elementary School	2400	58	Proposed Route, U3i
Church	St. Michael Ukrainian Catholic Church	2500	58	Proposed Route, U3i
Church	Tucson Tabernacle	5100	52	Proposed Route, U3i
Church	Flowing Wells Assembly of God	2300	58	Proposed Route, U3i
School	Walter Douglas Elementary	2900	58	Proposed Route, U3i

Table C-11. Route Group 4: Noise Sensitive Receptors within Analysis Area (Continued)

Type of Receptor	Name of Receptor	Distance from Edge of Representative ROW (feet)	Construction Noise Level at NSR (dBA)	Segment
Park	Jacobs Park	4100	52	Proposed Route, U3i
Cemetery	Evergreen Mortuary Cemetery	3000	58	Proposed Route, U3i
School	Luz Academy of Tucson	2900	58	Proposed Route, U3i
Park	Sweetwater Wetlands Park	700	69	Proposed Route, U3i
Church	Northside Fellowship Church	4200	52	Proposed Route, U3i
Church	Victory Worship Center	5000	52	Proposed Route, U3i
Church	Tucson Mountain Congregation	700	69	Proposed Route, U3i
School	Laguna Elementary School	4100	52	Proposed Route, U3i
Church	Northwest Southern Baptist Church	5000	52	Proposed Route, U3i
Park	Christopher Columbus Park	0	83	Proposed Route, U3i
Church	Lord of Grace Lutheran Church	3000	58	Proposed Route, U3i
Church	LDS Church	900	63	Proposed Route, U3i
Library	Wheller Taft Abett Library	2000	58	Proposed Route, U3i
School	Coyote Trails Elementary	900	63	Proposed Route, U3i
School	Redeemer Evangelical Lutheran School	400	69	Proposed Route, U3i
School	Rattlesnake Ridge Elementary	0	83	Proposed Route, U3i
School	Twin Peaks Elementary School	1000	63	Proposed Route, U3i
School	Tolson Elementary School	0	83	Local Alternative, TH1a
School	Tucson International Academy	1400	63	Local Alternative, TH1a
School	Maxwell Middle School	2000	58	Local Alternative, TH1a
Park	Greasewood Park	0	83	Local Alternative, TH1b
Park	Linear Park	300	74	Local Alternative, TH1b
Church	Most Holy Trinity Catholic Church	700	69	Local Alternative, TH1b
School	C E Rose Elementary School	3500	52	Local Alternative, TH3-OptionC
School	Pueblo Magnet High	1600	58	Local Alternative, TH3-OptionC
Park	Santa Cruz River Park	0	83	Local Alternative, TH3-OptionC
School	Carrillo Elementary	2500	58	Local Alternative, TH3b
Museum	Tucson Museum of the Arts	1900	58	Local Alternative, TH3b
School	Davis Bilingual School	1600	58	Local Alternative, TH3b
School	Ombudsmen - Charter Central	2200	58	Local Alternative, TH3b

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